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Per Bruun Famme

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For: A Method For Leakage Control And Localisation Of Leakages In The Internal Faces Of Heat Exchangers

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AMENDMENTS TO SPECIFICATION AND CLAIMS MADE VIA PRELIMINARY AMENDMENT

Amend the paragraph beginning at page 1, lines 4-8, as follows:

A first aspect of the present invention relates to a method of performing in situ leakage control in the internal faces that separate the product and service sides of heat exchangers[, as featured in the preamble of claim 1].

Amend the paragraph beginning at page 1, lines 10-13, as follows:

[Besides, a] A second aspect of the invention relates to a method of localizing leakages in the internal faces that separate the product and service sides of heat exchangers[, as featured in the preamble of claim 2].

Amend the paragraph beginning at page 1, lines 15-27, as follows:

The two aspects of the invention can be used separately; the first aspect for leakage control and the second aspect for localization of leakages that have been detected. However, they are usually used in combination, whereby a determination is initially carried out whether a heat exchanger leaks, and subsequently – if any such leakage is detected – the location of the leakages is determined. It follows that, in accordance with a third aspect, the invention relates to a method comprising in situ leakage control and localization of leakages in the internal faces that separate the product and service sides of heat exchangers[, as featured in the preamble of claim 9].

Amend the paragraph beginning at page 5, lines 1-8, as follows:

This technology, which is known from [ia] U.S. patent No. 4,745,797 relating to a method wherein a mineral oil based colour solution is applied to the surface of the object on which it is desired to perform the test. The colour solution that penetrates through leakages in the surfaces causes a subsequent colour reaction on the opposite side of the surface, thereby revealing the leakage.

Amend the paragraph beginning at page 5, lines 10-13, as follows:

An indirect colour method for localising cracks in a surface is described [ia] in DE patent No. 1,773,270, where the penetrating substance is not readily visible, but it is rendered visible by exposure to UV-light.

Amend the paragraph beginning at page 7, lines 18-34, as follows:

[The method according to the preamble of claim 1 is thus characterised in that] In accordance with the invention, a first step is concerned with leakage control, wherein one of the primary and secondary sides of a plate heat exchanger is supplied with a colorant liquid while the opposite side is supplied with a clear liquid that is recycled[, whereby the]. The presence of leakages in the heat exchanger is verified by detection of the presence of colorant in the clear liquid. Hereby a reliable indication is obtained whether the heat exchanger leaks, and since it does not present any problems to find an environmentally friendly and very powerful colorant that can be measured in very small concentrations in the clear liquid, the method is both reliable and inexpensive. Moreover, it is quite simple to imitate the operating conditions during the leakage control, thereby ensuring that the control does in fact indicate the leakages that will occur in actual operation, neither more nor less.

Amend the paragraph beginning at page 8, lines 1-17, as follows:

In accordance with the second aspect of the invention [as featured in the preamble of claim 2], [the] certain advantages are [obtained in that] achieved when a colorant-containing liquid is supplied to [the] one side of the heat exchanger, and [that] when this side is pressurised for a period of time[,]. [whereas the] The other side is [allowed to continue to contain] maintained at ambient in that it contains air[,]. [following which] After the period of time, the heat exchanger is drained and the plates are separated. [and the leakages] Leakages are then determined by visual inspection of the plates. It is possible to find a colorant for this purpose that will, on the one hand, be readily dissolved and, on the other hand, subsequently produce very clear indications on the opposite side of the locations of the leakages. At the same time it is very simple, by this method, to imitate the heat exchanger operating conditions. [, which] This

means that the detected leakages are the same or about the same as will appear in actual operation.

Amend the paragraph beginning at page 8, lines 25-31, as follows:

[As stipulated in claims 3 through 5] In accordance with an optional feature of the invention, the leakage control and the localisation of leakages [are] may be accomplished in conditions that are very close to or identical with the actual operating conditions of the heat exchanger. This involves substantial advantages since the leakages detected in this manner will be the exact same as those occurring in ordinary operation of the heat exchanger.

Amend the paragraph beginning at page 8, line 33, through page 9, line 4, as follows:

The colorant used [in the method according to claim 1 or 2,] can be any one of liquid or dissolvable colorant or mixtures of such substances that will, in an aqueous and highly diluted in-use solution, directly – or [as featured in claim 7] by means of UV-light – trigger a visualisation.

Amend the paragraph beginning at page 9, lines 6-20, as follows:

According to [an] another embodiment [as featured in claim 8], an aqueous solution of the fluorescent colorant uranine (the sodium salt of fluoresceine) is used [that distinguishes itself in having] . This solution has a very intense colouring and powerful fluorescence that makes it easy to visualise with UV-light in very small amounts (a dilution of uranine in a ratio of 1 to 200 mill in pure water can readily be detected by the human eye)[, and in being]. Advantageously, this colorant is approved for use as trace substance for, among other things, life saving at sea, tracing of subterranean water current and checking of weak blood circulation in humans. Thus there will not be any problems associated with obtaining permissions to use this substance in the foodstuffs industry, and it does not present an environmental hazard.

Amend the paragraph beginning at page 9, line 22, through page 10, line 6, as follows:

As [stipulated previously, it will be associated with] explained above, considerable advantages [to] are achieved with use of the methods for leakage control and localisation of leakages[, respectively,] in accordance with [a combination of claims 1 and 2; and these] the invention. These advantages [are] may be obtained by [– as stipulated in claim 9 –] performing a leakage control [being performed] in a first step [in which] by supplying a colorant-containing solution [is supplied] to one of the product and service sides[, whereas a] of the heat exchanger. A of the heat exchanger. A clear liquid that is preferably recycled is applied to the opposite side[, whereby the] . The presence of leakages in the heat exchanger is verified by detection of

the colorant in the clear liquid[; and in a second step being performed in which]. Also, the presence of leakages [is] may be revealed by pressurisation of the side containing the colorant-containing solution for a period of time while the other side is allowed to continue to contain air[, following which the]. The heat exchanger is thereafter drained and disassembled, and the localisation of the leakages is determined by visual inspection of the plates.

Amend the paragraph beginning at page 10, lines 20-25, as follows:

This renders the method according to [claim 9] the invention equally suitable for control of leakages in all types of heat exchangers in true operating conditions independently of the specific construction, field of use and operating specifications of the individual heat exchanger (pressure, temperature, viscosity of liquids, etc.).

Please amend Claims 1-9 as follows:

1. (Amended) A method for leakage control of the internal faces that separate the primary and secondary sides of a plate heat exchanger [, characterised in that] comprising the steps of:

supplying a colorant-containing liquid [is supplied] to one of the primary and secondary sides,

[while] supplying a clear liquid that is recycled [is supplied] to the opposite side,

[in which method for leakage control the] maintaining a differential pressure between the primary and secondary sides [is] close to or [identical with] approximately the same as the differential pressures prevailing during actual operation of the heat exchanger, [whereby the presence of] and

determining whether leakages in the plate heat exchanger [is verified] are present by [detection of] detecting the presence of the colorant in the clear liquid.

2. (Amended) A method for localization of leakages between the primary and secondary sides of a plate heat exchanger by use of a colorant that passes through the leakage and is subsequently detected visually comprising the steps of, [characterised in that]

supplying a colorant-containing liquid [is supplied] to the [one] primary side of the plate heat exchanger,

[and that this] pressurizing the primary side [is pressurized] for a period of time, [while the opposite side contains air,]

[following which] draining the colorant-containing liquid from the plate heat exchanger, [is drained and disassembled,] and

determining the location of [the] leakages [is determined] by visual inspection of the plates.

3. (Amended) A method according to claim 2, [characterised in that] further comprising the step of:

[the] maintaining a differential pressure between the primary and secondary sides [is] close to or identical with the differential pressures prevailing during actual operation of the plate heat exchanger.

4. (Amended) A method according to claim 1 [or 2, characterised in that] wherein the viscosity of the colorant-containing liquid corresponds to the viscosity of the liquid that passes through the corresponding side of the plate heat exchanger in actual operation.

5. (Amended) A method according to claim 1 [or 2, characterised in that] wherein the passage of the colorant-containing liquid corresponds to the passage on the corresponding side of the plate heat exchanger in actual operation.

6. (Amended) A method according to claim 1 [or 2, characterised in that] wherein the colorant is a fluorescent substance.

7. (Amended) A method according to claim 1 [or 2, characterised in that] wherein the detection of the colorant is effected by use of UV-light.

8. (Amended) A method according to claim 1 [or 2, characterised in that] wherein the colorant is a salt of fluoresceine [, preferably the sodium salt uranine thereof].

9. (Amended) A method for in situ leakage control and localisation of leakages in the internal faces that separate the primary and secondary sides of a plate heat exchanger[,] comprising the steps of:

[characterised in that a leakage control is performed in a first step wherein] supplying a colorant-containing liquid [is supplied] to one of the primary and second sides[,] of the plate heat exchanger;

[while a] supplying a recycled clear liquid [that is recycled is supplied] to the opposite [,] side of the plate heat exchanger;

[in which method for leakage control] maintaining the differential pressure between the primary and secondary sides [is] of the plate heat exchanger close to or identical with the differential pressures prevailing during actual operation of the heat exchanger[,] ;

[whereby] detecting the presence of leakages in the plate heat exchanger [is verified] by detection of the presence of the colorant in the clear liquid;

[and that, in a second step, the presence of leakages entails that the] maintaining the colorant-containing liquid [on one side remains pressurised] at a predetermined pressure for a period of time, while the clear liquid id drained from the opposite side [is drained to contain air,] ; and

[following which] draining and disassembling the plate heat exchanger [is drained and disassembled, and] to determine the location of the leakages [is determined] by visual inspection of the plates.

Please add the following claims 10-16:

10. (New) A method as in claim 8 wherein the slat of fluorescence is a sodium salt uranine thereof.

11. (New) A method according to claim 2 wherein the viscosity of the colorant-containing liquid corresponds to the viscosity of the liquid that passes through the corresponding side of the plate heat exchanger in actual operation.

12. (New) A method according to claim 2 wherein the passage of the colorant-containing liquid corresponds to the passage on the corresponding side of the plate heat exchanger in actual operation.

13. (New) A method according to claim 2 wherein the colorant is a fluorescent substance.

14. (New) A method according to claim 2 wherein the detection of the colorant is effected by use of UV-light.

15. (New) A method according to claim 2 wherein the colorant is a salt of fluoresceine, the sodium salt uranine thereof.

16. (New) A method as in claim 8 wherein the salt of fluorescence is a sodium salt uranine thereof.